

## Making Paint Pigments

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Block: \_\_\_\_\_

### Data Table

Name of Compound	Color of Compound
Vermillion	
Aureolin	
Malachite	
Lapis Lazuli	

**Questions:** Answer the following questions on a separate piece of paper using complete sentences.

1. The formation of the vermillion pigment is from the reaction of  $\text{Fe}(\text{NO}_3)_3$  with KSCN. When these chemicals react,  $\text{KNO}_3$  and vermillion are formed. What is the chemical formula for the vermillion pigment? 2
2. The formation of the aureolin pigment is from the reaction of  $\text{Fe}(\text{NO}_3)_3$  with NaOH. When these chemicals react,  $\text{NaNO}_3$  and aureolin are formed. What is the chemical formula for the aureolin pigment? 2
3. The formation of the malachite pigment is from the reaction of  $\text{CuSO}_4$  with  $\text{CaCO}_3$ . When these chemicals react,  $\text{CaSO}_4$  and malachite are formed. What is the chemical formula for the malachite pigment? 2
4. The formation of the lapis lazuli pigment is from the reaction of  $\text{CuCl}_2$  with NaOH. When these chemicals react, NaCl and lapis lazuli are formed. What is the chemical formula for the lapis lazuli pigment? 2
5. When we write the name for  $\text{Fe}_2\text{O}_3$ , we need to write it as iron (III) oxide, but when we have NaCl, we write it as sodium chloride, NOT sodium (I) chloride. Why do we need to put a roman numeral to indicate the charge of the iron cation, but not the sodium cation? 2
6. Why do you think alchemists sometimes accidentally created pigments when trying to make gold?

## Making Paint Pigments

### Introduction

**Transition metals** are metals that are found in the middle of the periodic table (groups 3-12). Due to the structure and location of the electrons in transition metals, they tend to form very colorful compounds. Since gold is a transition metal, alchemists often worked with other transition metals in an attempt to change them into gold. As such, alchemists discovered a lot of colorful compounds, which were eventually used as paint pigments. Another characteristic of transition metals is that they often form multiple ions. For example, iron can form two ions –  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$ . In order to distinguish between the two ions, we name them iron (II) and iron (III). Iron(III) oxide is a paint pigment known as red ochre. Many paint pigments used today are transition metal compounds.

### Procedure

1. Obtain four test tubes
2. Use a marker, and, starting at the bottom of a test tube, mark two lines 1 cm apart. Repeat for all test tubes.

#### *Vermillion*

1. Add Iron (III) nitrate to the first line, then add potassium thiocyanate to the second line of a test tube.
2. Gently mix the two solutions with a clean stirring rod. Allow the test tube to sit for a minute, then record the color of the precipitate in the data table.

#### *Aureolin*

1. Add iron (III) nitrate to the first line of the test tube, then add sodium hydroxide to the second line of the test tube.
2. Gently mix the two solutions with a clean stirring rod. Allow the test tube to sit for a minute and record the color of the precipitate in the data table.

#### *Malachite*

1. Add copper (II) sulfate to the first line of the test tube, then add sodium carbonate to the second line of the test tube.
2. Gently mix the two solutions with a clean stirring rod. Allow the test tube to sit for a minute, then record the color of the precipitate in the data table.

#### *Lapis Lazuli*

1. Add copper (II) chloride to the first line of the test tube, then add sodium hydroxide to the second line of the test tube.
2. Gently mix the two solutions with a clean stirring rod. Allow the test tube to sit for a minute, then record the color of the precipitate in the data table.